

Source Identification of Derelict Fishing Gear: Issues and Concerns

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Background

No fewer than four international conferences have convened to address the problem of marine debris and derelict fishing gear (Shomura and Yoshida 1985, Alverson and June 1988, Shomura and Godfrey 1990, Faris and Hart 1995). Each of these conferences has addressed identifying the land or maritime sources of debris, including the fisheries which generate derelict gear such as nets, net fragments, and traps. The impetus for source identification has been primarily to provide direction for activities designed to prevent continued accidental loss or intentional discard of such gear. These activities include improved port disposal facilities, public awareness campaigns, and gear modifications. With the ratification of Annex V of MARPOL 73/78, which prohibits the discharge of plastics from ships of nations party to the Annex, source identification gained added importance as a law enforcement tool, although any citation or enforcement action would require identification ascribed to a particular vessel.

Derelict fishing gear can be identified with increasing degrees of precision, from fishery, to manufacturer, to individual user. Source identification to a particular fishery requires a broad knowledge of fishing equipment and methods. This expertise no doubt exists collectively among fishermen, gear manufacturers and specialists, and biologists, and some compendia have been assembled (Uchida 1985). However, summary publications quickly become outdated as technology and fishing methods change, and current information may not be published or readily accessible. Identification of a manufacturer requires unique elements which are introduced during construction of the particular webbing, net, or other gear implement. These may be intentional tracers introduced to function as a de facto trademark, or may be particular aspects of construction which result from the manufacturer's (patented) design or fabrication.

Identification to individual user requires insertion or application of unique identifiers after the gear has been purchased from the manufacturer or supplier. These procedures are used in trap fisheries in which return of lost equipment is desired, including tagged crab or lobster traps, or color coded buoys. Set net fisheries may also have individual markings on buoys, although the webbing is not marked. Trawl or drag fisheries seldom have individual markings.

Previous Recommendations

Each of the previous conferences has provided a suite of recommendations related to the detection, management, and mitigation of marine debris. Some of these recommendations have related to the identification of debris sources, and are listed below.

1984 Recommendations

Recommendations from Marine Debris working group:

1. Fishermen groups and net manufacturers should be asked to assist in identifying specific types of nets and net components which are most involved in entanglement.
2. Requirement for identification of fishing nets to identify source and areas lost.
3. Confirm sources of marine debris and expand studies of their distribution in the marine environment.

Recommendation from Impacts working group:

1. Require Net Identification
2. Develop a reference collection of debris, particularly nets

Recommendations from Management Needs working group:

1. A reference catalogue of netting materials be developed
2. Economical and effective systems be developed to mark gear through color coding or other means for retrieval and identification of source.

1988 Recommendation

1. Examination of cost-effective systems to facilitate the identification, recovery, and return of lost fishing gear to port or owners.

1990 Recommendation

Recommendations from working group on Entanglement of Marine Life

1. The preparation of a guide to the types of lost or discarded nets.

1994 Recommendation

1. Where possible, sources of marine debris should be identified by countries of origin and user groups using item codes and shapes from industry, epiphytic organisms (that travel on ocean borne debris) and cargo manifests.

Actions Since Previous Conferences

Reference Collection

Commencing in fiscal year (FY) 1985, the U.S. Congress provided funds to the National Marine Fisheries Service (NMFS) for a comprehensive research and management program to address the problem of marine debris. The resulting Marine Entanglement Research Program (MERP) coordinated mitigation, education, and research activities for ten years, until its funding was discontinued in FY 1996 (Marine Mammal Commission 1997). MERP supported a wide suite of projects, but little support was garnered for identifying debris sources. A project was funded (\$48.0K) for one year, FY 1985, to establish a reference collection for nets, but by the following year this project was discontinued in lieu of funding for other, higher priority activities. The one-year effort resulted in an incipient reference collection at the Alaska Fisheries Science Center (AFSC) in Seattle, Washington, with notification that the AFSC would accept samples for identification (Herkelrath *et al.* 1991). Parts of the original reference collection remain at the AFSC (Jim Coe, AFSC, pers. commun.). No reports resulted from the project.

Since 1986 no formal effort has been undertaken to establish a reference collection of nets or other fishing gear. The original reference collection has not expanded, and has seldom been used (Dave King, AFSC, pers. commun.) One of the authors (JRH) used a collection of net samples collected by U.S. fisheries observers in the early 1980s to assist identification of debris collected from the Northwestern Hawaiian Islands in 1998. However, this ad hoc collection resulted in tentative identification of only 36% of the webbing samples collected, and only 14% with a high degree of certainty (NMFS Unpubl. data). The collection was obviously not complete, and may have been outdated.

Individual Gear Markers

Unique marking of fishing gear has progressed little beyond painting or tagging of buoys and floats to which traps or set nets are attached. These methods do not identify scraps of webbing or other gear fragments which become detached from the buoys. Identification of fragments requires small, unobtrusive markers which do not affect the performance or durability of the gear. One such marker is a coded wire tag (CWT) developed for biological applications (Jefferts *et al.* 1963). CWTs are used in fisheries worldwide, and have been suggested as suitable for use to tag gear (Jefferts, 1988). Tags would be implanted in line or webbing at intervals close enough to provide identification of even small scraps of debris.

It may be technically possible to more closely identify the source of derelict gear fragments, particularly if the full capability of forensic science is applied. Potentially useful forensic methodologies exist that could be brought into the identification of gear fragments.

Although the technology exists to identify derelict gear down to the user level, application of the technology requires careful consideration of many factors. Extra expense would accrue to any manufacturers providing gear containing the individual tags, which would likely result in higher costs to the consumer. A database of registered gear owners would need to be established and

maintained, on either a national or a multinational scale.

Oceanic Regime, Drift Patterns

Knowledge of oceanic drift patterns is generally most useful in determining where pelagic flotsam is likely to accumulate. Kubota (1994) simulated the effects of Stokes drift, Ekman drift, and geostrophic currents on theoretical debris items placed throughout the North Pacific. The resulting movement predicted all debris becoming situated in a narrow band running approximately ENE-WSW, crossing the Northwestern Hawaiian Islands (NWHI) in the vicinity of Laysan and Lisianski Islands. Theoretical debris items placed across the North Pacific Ocean at 45°N were predicted to concentrate, forming an area of high debris density at 27°N, 170°W, approximately 220 km NE of Laysan Island. Matsumura and Nasu (1996), summarizing six years of surveys documenting drifting debris, confirmed that the Pacific region north and northeast of Hawaii showed relatively high densities of fishing gear and nets.

Ongoing analyses (Brainard and Foley, unpubl. data) have used scatterometer winds to compute oceanic convergence/divergence, a useful means to examine accumulation of debris by wind driven currents. These analyses reveal seasonal and interannual variability in the NWHI. Additional analyses will improve the ability to predict the fate of derelict gear.

Knowledge about drift patterns provides little information on the sources of derelict fishing gear. Variability in oceanic currents and wind drift prevents accurate “back calculation” of the site where debris would have been introduced. Moreover, the length of time which an item has been adrift is never precisely known; any derelict gear could have circulated in a gyre for long periods of time, having been lost or discarded in any area contacted by the circulating water mass.

Political Considerations

Previous discussions between government regulators and fishing industry representatives (Anonymous, 1988) have revealed very serious concerns among fishermen regarding individual gear markers, such as CWT marking. Fishermen have expressed concerns about the potential legal liability of having their gear individually marked for debris fragment identification. Beyond the information collection infrastructure necessary, the political repercussions of gear tagging need to be carefully considered.

Dissatisfaction with a proposed regulation should not be grounds to abandon its consideration. Many regulations currently in place to protect the marine environment are not particularly popular, but are nonetheless effective and deemed necessary to protect the public interest. However, it is not currently evident that the potential benefits of gear marking would be worth the costs. If derelict gear is found at French Frigate Shoals, Hawaii that had been sold to the "F/V *Sloppy Seas*" in Alaska, what exactly does that mean for regulators and educators? Moreover, do better ways than gear marking exist to reduce discards or lost gear from this and other vessels?

Unresolved Issues

If source identification is to be practical, it must contribute substantially to reducing debris at its source. A central issue is to determine how source identification might contribute to debris reduction. Ignorance of how source identification could help mitigate the derelict gear problem may have contributed to the historic lack of attention by government regulators to the issue of source identification.

The overall intent of source identification is to detect spatial and temporal patterns or trends in derelict fishing gear entering the marine environment. Derelict fishing gear in the marine environment has two very distinct origins--intentional and illegal discards, and unintentional loss. The mitigation options for each scenario are distinctly different. If a significant percentage of problem debris (such as derelict gear that is responsible for entangling sensitive marine organisms) were identified to a particular fishery, more investigation and mitigation could be directed toward that fishery. These could include such efforts as learning whether these gear fragments are intentionally discarded or accidentally lost, increased outreach/education activities, fishery management solutions, or fishery-specific incentives.

For example, if a significant amount of net and line fragments that are entanglement threats can be identified to, say, a Taiwanese shrimp trawl fishery in the South China Sea, then various mitigation options are available. If the fragments appear to have been intentionally discarded, as evidenced by trimmed edges characteristic of webbing patches removed for repair, then mitigation options for that fishery could include increased observation by onboard fishery observers, port/vessel inventory systems, gear marking, rewards for reporting violations, punitive fines for violations, market-based/consumer pressure, and education of deck hands and skippers regarding the deleterious effects of intentionally discarded fishing gear. If, on the other hand, the gear fragments appear to have been accidentally lost, evidenced by large, obviously stretched, frayed, chafed, and torn components, then other management solutions might be considered. Areas of known trawl hang-ups or rough bottom that contribute to a large amount of torn and lost gear could be closed to trawling, gear modifications might be instituted, or Individual Fishing Quotas (IFQs) might be implemented. IFQs assign fishing rights to individual vessels/owners, thereby allowing the fleet to fish in a more leisurely, safer manner and on less difficult bottom terrain. In serious cases, managers might consider closing fisheries entirely to specific problem gear types (as occurred in the high-seas driftnet fishery).

Mitigation options should be targeted as specifically as possible for three principal reasons: 1) to have maximum effectiveness; 2) to make the best use of limited financial resources; and 3) to avoid unfairly burdening other nonproblem fisheries. If derelict gear can be identified to a particular fishery, then mitigation options need not be applied unnecessarily to other fisheries.

Points for Working Group Discussion

- What is the feasibility of developing a gear reference collection?
- How would a reference collection be used? By what groups? For what purposes?
- How would a reference collection be developed? Where would it be maintained?
- How could a reference collection be kept current?
- What is the feasibility of individually tagging gear?
- What are the benefits or disadvantages of gear tagging?
- How would the infrastructure be developed to establish a gear registry?
- What agency or agencies would maintain the registry?
- What would be some uses of a registry? MARPOL enforcement? education?
- What are the political ramifications of individually tagging gear?

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